



US009410993B2

(12) **United States Patent**
Terdan et al.

(10) **Patent No.:** **US 9,410,993 B2**
(45) **Date of Patent:** **Aug. 9, 2016**

(54) **CIRCUIT THAT DECIPHERS BETWEEN AC AND DC INPUT SIGNALS**

(71) Applicant: **ROCKWELL AUTOMATION TECHNOLOGIES, INC.**, Mayfield Heights, OH (US)

(72) Inventors: **Dale R. Terdan**, Concord Township, OH (US); **Sean P. Overberger**, Streetsboro, OH (US)

(73) Assignee: **Rockwell Automation Technologies, Inc.**, Mayfield Heights, OH (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 208 days.

(21) Appl. No.: **14/317,325**

(22) Filed: **Jun. 27, 2014**

(65) **Prior Publication Data**

US 2014/0306691 A1 Oct. 16, 2014

Related U.S. Application Data

(63) Continuation of application No. 13/688,312, filed on Nov. 29, 2012, now Pat. No. 8,767,425.

(51) **Int. Cl.**

G01R 19/14 (2006.01)

H02J 5/00 (2016.01)

H05B 37/02 (2006.01)

G01R 19/00 (2006.01)

H02M 1/10 (2006.01)

G01R 19/155 (2006.01)

(52) **U.S. Cl.**

CPC **G01R 19/14** (2013.01); **G01R 19/0015** (2013.01); **H02J 5/00** (2013.01); **H05B 37/02** (2013.01); **G01R 19/155** (2013.01); **H02M 1/10** (2013.01); **Y10T 307/658** (2015.04)

(58) **Field of Classification Search**

CPC H05B 37/02; H05B 33/0809; H05B 33/0803; H05B 33/0815; H02J 5/00; H02J 9/02; G01R 19/14; G01R 19/145; G01R 19/0015; H02M 1/10; Y02B 20/40
USPC 315/307, 291, 294, 312, 86; 363/142, 363/143

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,977,351 A	12/1990	Bavaro et al.
5,737,204 A	4/1998	Brown
5,824,990 A	10/1998	Geissler et al.
6,903,950 B2	6/2005	Afzal et al.
7,067,992 B2 *	6/2006	Leong F21K 9/00 315/291
7,859,874 B2	12/2010	Bovitz
2013/0020993 A1	1/2013	Taddeo et al.

* cited by examiner

Primary Examiner — Haissa Philogene

(74) *Attorney, Agent, or Firm* — Boyle Fredrickson, S.C.

(57) **ABSTRACT**

Aspects of the present invention provide a module including an electronic circuit that flags the presence of AC or DC input signals. An AC filter receives an input signal and couples it to a first leg. The AC filter permits an AC signal to pass to produce a first output and prevents a DC signal from passing. A DC filter also receives the input signal and couples it to a second leg. The DC filter permits a DC signal to pass to produce a second output and prevents at least part of an AC signal from passing. A lock out circuit in the first leg prevents the second leg from producing the second output when the first leg produces the first output. The output of each leg may be digitized and coupled to a logic controller to flag the presence of AC or DC input signals.

20 Claims, 7 Drawing Sheets

